INTERNATIONAL ACCESS TO BIBLIOGRAPHIC DATA: MARC AND MARC-RELATED ACTIVITIES

ALAN HOPKINSON
British Library Bibliographic Services Division

Formats for the exchange of bibliographic data use the ISO 2709 record structure which started out as the structure for the Library of Congress MARC format. The *UNISIST Reference Manual* was an early international exchange format developed by ICSU-AB and Unesco and included cataloguing rules suitable for use by A & I Services. The national libraries developed UNIMARC under IFLA auspices as their exchange format since the national formats were not totally compatible. Unesco, concerned about the lack of compatibility between the major international exchange formats, sponsored a symposium, resulting from which a Common Communication Format was developed and ISO began work on a data element directory. International formats also exist for nuclear and agricultural information as well as for serials data. Other formats exist which are used internationally and have different structural characteristics. The International MARC Network Study Steering Committee has taken an interest in the exchange of bibliographic data and has organized a test of UNIMARC and supervised a *UNIMARC Handbook* to clarify the format. International exchange formats tend to acquire accompanying cataloguing rules: indeed they will only be really effective if there are internationally accepted cataloguing rules and authority files.

1. INTRODUCTION

THE PRECEDING PAPER by Anthony Long (*Journal of Documentation, 40*(1), March 1984, 1–12) shows how MARC began as an Anglo-American development and then spread world-wide. The main thrust behind MARC came from the Library of Congress and the feature which all the different national MARC formats had was their record structure, a record structure based on the international standard ISO 2709. In practice national formats have probably based their record structure directly on the Library of Congress MARC format. Within the United States, the record structure, but not the data element definitions nor the content designators identifying them became a national standard in 1971.[1] Three systems of content designators were included in the first edition as an appendix but not in the subsequent version in 1979.[2] The record structure alone was given the status of an international standard in 1973 as ISO 2709.[3] A common record structure was adopted to enable organizations to exchange records on magnetic tape. This structure reflects the state of the art in data processing at the time it was formulated; magnetic tape was an important storage medium since disk storage was expensive. The ISO 2709 structure consists of a leader or label containing data needed to process the records. For example, one code indicates the type of record, whether it relates to a book, serial, cartographic material etc., and another indicates the bibliographic level, analytic, monograph, serial or collection. Some systems which process records in ISO 2709 format depend on these codes to pull in the appropriate computer programs for processing. The leader is followed by a directory which identifies the types of data in the record and points to the posi-

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tions within the record of the data fields containing each element of data. ISO 2709 was developed specifically for processing magnetic tape. Access to data on tape is by nature sequential. Tapes are usually searched in one direction character by character. A directory enables those parts of the record which are required in processing to be located and others to be ignored. Tape is of course an ideal medium for exchange because it is cheap. Whenever ISO 2709 is adopted it is reasonable to suppose that it is intended that records produced by the system will be exchanged. This paper includes discussion of those formats which have adopted this record structure as their basis and should strictly be subtitled ISO 2709-related rather than MARC-related activities. The term MARC has come to be used for national formats based usually in the national library. Other formats are discussed here which are not usually called MARC because they are not national library-based such as the *UNISIST Reference Manual* format. Nevertheless, they fulfil exactly the same function, that of being a record format and system of content designators for the exchange of bibliographic records.

It is worth remarking that the structure of ISO 2709 includes fields, subfields and indicators. There are four implementations for the ISO 2709 record structure, one making use of neither indicators nor subfields, one using indicators only and a further one with subfields and indicators; abstracting and indexing services that use ISO 2709 tend to prefer to adopt the implementation with neither, and MARC formats use both subfields and indicators. Indicators always immediately precede the data in the field to which they refer; when fields are divided into subfields, each subfield is preceded by an identification code (usually of two characters in length) which is embedded in the data. The effect of this has been to introduce a certain element of rigidity into MARC formats since many systems find it inconvenient to remove this embedded control data from the text when displayed, for example, in online retrieval systems. Subfields have tended to be used to isolate sub-elements of data which require special treatment in display such as italicization or which need special treatment when filing. Certain MARC formats such as UK MARC and UNIMARC use them to determine the punctuation in the catalogue record when it is displayed, enabling the receiving agency to determine what punctuation should appear in a record. Thus, the exchange format structure has influenced the internal form of data in systems.

2. UNISIST REFERENCE MANUAL: AN EARLY INTERNATIONAL EXCHANGE FORMAT

Within the US in particular, MARC was seen as the solution to the bibliographic record processing requirements of the Library of Congress and the library community. At the same time secondary information services were investigating the possibility of a market for the records they were producing as a by-product of the systems which produced their printed abstracting and indexing journals which were increasingly being automated. ICSU-AB, the International Council for Scientific Unions Abstracting Board, in conjunction with Unesco were working together on a project known as UNISIST, the aim of which was to investigate the feasibility of a world scientific information system. They set up eight working groups for this, one of which was the Working Group on Bibliographic Descriptions. This Working Group included representatives of ICSU-AB member services and organizations with special interests in mechanized information processing including ISO, FID, IFLA, INIS and OECD. They initi-

ated the first attempt outside of a national bibliographic agency to develop an exchange format, and its aim was to cater for international requirements from the start. The *Manual* was developed during the period 1967 to 1971 when a first draft[4] was ready and tested at the University of Sheffield Postgraduate School of Library and Information Science. The purpose of the test was to determine to what extent individuals with different backgrounds working in different environments could produce standardized bibliographic descriptions of identical sample items using the *Manual*. In the light of these tests, a few changes were made to the *Manual*. The data element definitions were enhanced and became more complete and began to resemble cataloguing rules. The tagging scheme was changed to an alphanumeric system to avoid confusion with the existing all-numeric MARC system. The first edition was published in 1974.[5]

It stated in its introduction that it was a 'specification manual , not an instructional or cataloguing manual'. It was not intended to be or become an international standard. What it had tried to do was 'to define a minimum set of data elements which could be agreed upon by abstracting and indexing services in order to enable them to present their computer-based products to the user in a more compatible and therefore more easily usable form'. At this time there was no international MARC format although the British Library, Library of Congress and the National Library of Canada were exchanging records. Therefore this format aimed at A & I services was in a sense the first international format not confined to a particular user system. A & I services record articles in journals, conference proceedings etc. as well as monographs and sometimes newly published serials. Therefore, the *Manual* had to cater for the inclusion in one file of records relating both to analytics and to monographs. Serials in their own right were excluded possibly for a political reason: the UNISIST programme was already supporting the recording of serials in ISDS. The *Manual* accommodated the different bibliographic levels by allocating certain key data elements to fields which depended on their bibliographic level. An article in a monograph might well have the following fields which are linked to their respective bibliographic level:

> Author of article—title of article—editor of monograph—title of monograph—pagination of article—collation of monograph—title of monographic series.

Other data elements were not categorized by bibliographic level, such as publisher, report number, ISBN, availability. Some of these could apply only to one level, but others such as report number may belong to more than one level.

Having produced the format, Unesco in its role of sponsor of standardization activities maintained it in co-operation with the British Library, who set up the UNISIST International Centre for Bibliographic Descriptions (UNIBID) for this purpose, a full account of which is given by Dierickx.[6] An attempt to define each data element has resulted in the *Reference Manual* containing what could be called, without any stretch of the imagination, cataloguing rules. Indeed, in the introduction to the *Reference Manual*, 2nd edition,[7] it states that reports on the use of the first edition as a source for bibliographic description and cataloguing rules, as much as an exchange format, have encouraged the compilers of the current edition to make it suitable for use by non-computerized as well as by computerized services. This means that it is intended to be a set of cataloguing rules as well as guidelines for a machine-readable exchange format. Organizations are making use of the *Reference Manual* for a variety of purposes. Packer and Conning describe its

use in the DOCPAL system[8] and Hopkinson gives a concise review of its use in general which is a little outdated.[9]

A model example of the advantages of using an exchange format is found in Mulvihill,[10] who relates how the American Geological Institute were able to exchange geological data from the GeoRef database with the French Bureau de Recherches Géologiques et Minières and the Centre National de la Recherche Scientifique (CNRS). GeoRef had adopted the *Reference Manual* format in 1975, just after publication, and CNRS had been involved in the preparation of the *Reference Manual,* the format for their PASCAL system having been under development during the period when the *Reference Manual* was being developed.

3. UNIMARC: UNIVERSAL MARC FORMAT

To return to the national libraries, each library was developing its own national format. The only feature they had standardized was the record format which was to become the ISO 2709 standard. Each national agency had added data elements to suit its own requirements, and even as early as 1971 it was clear that the assignment of tags, indicators and subfield identifiers was so varied between national formats that tailor-made programs would have to be written by any national agency that wished to use records from another. Within the Library of Congress, different content designators were being proposed for each material (MARC Books, MARC Serials, etc) and this added to the complexity of the situation for recipients of records. Consequently in 1971 a recommendation was made to IFLA that they assume the responsibility for establishing an international standard for content designators.

The recommendation of 1971 was taken up at the IFLA General Conference in August 1972 where the IFLA Committees on Cataloguing and Mechanization respectively jointly sponsored the formation of the IFLA Working Group on Content Designators.[11] This Working Group was given the task of investigating the differences in content designation, exploring how best these differences could be accommodated and aiming at a recommended standard for the international exchange of bibliographic data in machine-readable form, which was to be called the MARC International Format and renamed UNIMARC in 1975.

The first deliberations of the Working Group, as recorded in the foreword to the first edition of UNIMARC[12] resulted in the realization that lack of standardization in cataloguing codes and practices prevented the definition of an international exchange format which would enable data created by one national agency to be incorporated into the databases of another national agency exactly as received. Differences in subject systems and headings in name authority files, on top of language differences, work against compatibility of data exchanged between national libraries. Therefore it was felt that each country should have a national system, and this would be the responsibility of an agency which would translate records from the national format into the international format. It was agreed however that the International Standard Bibliographic Descriptions (ISBD)[13] should be the basis of the descriptive data elements within the format.

4. COMMON COMMUNICATIONS FORMAT

By 1976 the *UNISIST Reference Manual*[5] had been available from Unesco for over a year and a second provisional draft of UNIMARC had received wide distribu-

tion. Internally in Unesco, as a result of resolutions at the 19th Session of the General Conference of Unesco in November 1975,[14] the NATIS programme and UNISIST programme were being combined into what is now the General Information Programme. The emphasis there was on bringing closer together divergent practices within the information community, i.e. between libraries, documentation or abstracting and indexing services and archives. The General Information Programme staff were receiving many requests from developing countries to assist in setting up information systems. These were sometimes secondary information services intended to be centred on national libraries, or national or regional bibliographies in small countries where it was hoped to include journal articles as well as monographs. The staff in Unesco felt they did not want necessarily to recommend the use of their *Reference Manual* in such situations if it would mean that these national agencies would be excluded from an international MARC network which might be established. To find out more about the problems which could result from this polarization between what can be termed the library and the information communities, in the area of the exchange of bibliographic data and merging of bibliographic data files, Unesco sponsored the International Symposium on Bibliographic Exchange Formats which was held in April 1978.[15] This Symposium went a long way towards halting the increasing polarization between the abstracting and indexing and national library communities.

Two activities were sparked off by the Symposium. Unesco set up the Ad hoc Group on the Establishment of Common Communication Format which has now produced a format shortly to be published[16] and the ISO Technical Committee on Documentation (TC 46) set up a new Sub-Committee on Bibliographic Data Elements in Manual and Machine Processing with a Working Group on Documentary Data Elements. In fact an informal working group met immediately after the Symposium to plan the future work of this Group, which was to include the preparation of a data element directory.

At first the development of the Common Communication Format (CCF) and the work of the ISO working group took place in parallel. Later on, each went its separate way, though the convener of the ISO working group was a member of the Ad hoc Group on the Establishment of CCF. The members of the Ad hoc Group requested that Unesco commission a data element directory taking into account the data elements of UNIMARC, USSR/US Common Communications Format, MEKOF, ISDS and *Reference Manual.* A consultant prepared a KWOK index to all the data elements in the formats and an abbreviated data element definition for each data element. These became the basis for the discussions which revolved around trying to find a mandatory core set of elements. At one stage it looked as though the project might flounder since some members felt that their organizations would have no use for records with the lack of specificity of data element definition that was being proposed. However, all members eventually agreed that the format was specifically intended for holding records from different kinds of sources, libraries and A & I services, and would be used, for example, by agencies in developing countries who wanted to take records from both sources and to contribute to them.[17] It was tacitly recognized that agencies requiring strict adherence to their own standards within their databases would continue to use the already existing formats and that if they received records in the CCF format they might have to edit them. The format consists of mandatory data elements and optional data elements. Other data elements may be agreed between

exchanging agencies. The record structure uses the new fourth directory element in the 1981 version of ISO 2709[18] to denote bibliographic level, field occurrence and segment occurrence. Each field has to be defined as belonging to a particular segment as any field can be used equally in any segment at any level. A sophisticated but simple-to-use record-linking technique has been devised which allows very precise relationships to be made between two or more segments within a record or between fields.

5. ISO DATA ELEMENT DIRECTORY

The ISO group also began by selecting mandatory data elements. They used the work prepared by the consultant to draft data element definitions for important bibliographic data elements. However, they have since decided to specify sets of data elements for different applications and have started on the data elements required for interlibrary loan.[19] They are next going to tackle data elements needed for acquisitions. This work is being done within the framework of Open Systems Interconnection (OSI),[20] a project which aims to enable the exchange of data between unrelated systems which conform to the international standards already developed or which are being developed for OSI, or which at least implement interfaces conforming to these standards. These standards deal with the range of standards required from the physical level, i.e. the actual mechanical connections, whether wires or wireless, through other levels which deal with data transfer, e.g. character sets, up to the rules that govern the data being exchanged enabling it to be interpreted by the receiver, i.e. content designators and codes, which depend for their meaning on data element definitions.

6. CENTRALIZED NETWORK FORMATS

Another kind of international format is represented by the INIS and AGRIS systems.[21] These are both UN information systems providing originally hard copy but now, additionally, online access to databases which are compiled by distributed input. Dealing with atomic energy and agriculture respectively, the records in these two databases are prepared in national centres throughout the world and sent on worksheets or on tape or diskette to the processing centre. In some cases the records are prepared for other systems and converted to the INIS or AGRIS format for input to that system. The INIS system, automating in 1970, came first and the AGRIS system was very much based on it using the same processing centre from 1972. These systems are always called decentralized systems by their staff, but compared with less formal networks, such as the network of national libraries, they are very much centralized. Not only do they have centralized input; the systems are very much centrally controlled. For example all centres use standard worksheets, identical cataloguing rules which owe a great deal to AACR, and they maintain an Authority List for Corporate Entries and Report Number Prefixes.[22] Authors' names are entered according to AACR with the help of the IFLA publication *Names of persons: national usages for entry in catalogues.*[23] Exchange tapes are available in ISO 2709 format for the INIS Atomindex and AGRIS Agrindex file. The format does not use indicators or subfields and it uses field 002 as a sub-record directory to enable the data relating to the separate bibliographic levels, subject data or abstracts to be individually processed.

7. INTERNATIONAL SERIALS DATA SYSTEM

The International Serials Data System is a similar kind of network, with centralized control of distributed input. The main difference between the systems lies in the nature of the inputting agencies. In the case of AGRIS and INIS most of the records produced are intended only for those systems. On the other hand, national libraries usually house the national serials data systems. The fact that the requirements of the ISDS format are different from those of the national MARC format and each is very strictly controlled usually means double input. As much as anything this is due to differences in the cataloguing rules between ISDS and ISBD on which most national cataloguing rules are now based in the descriptive area. The *Guidelines for ISDS*[24] were published in 1973 and minor amendments have been made to them since. The document is to be replaced by the *ISDS Manual*[25] which is shortly to be published. This document has been delayed since some changes have recently been made on both sides to align more closely ISBD[26] and ISDS practices. The ISDS format was itself developed using LC MARC as a model and its record structure is the same, ISO 2709 with subfields and two indicators.

8. MINISIS FORMAT

When discussing international formats, it is difficult to draw the line between a truly international format and a format that happens to be used in different countries. The distinction made here is whether the format has been developed by an international agency. All the formats just discussed have been developed by UN agencies or international organizations. One other format which does not have the same claim to international status though it is in use around the world is the format used in the MINISIS system developed by the International Development Research Centre (IDRC) in Ottawa as part of their DEVSIS project, the aim of which is to disseminate development information. The format proposed for DEVSIS was originally an extended version of the *Reference Manual*.[27] For MINISIS the format was changed to a 4-digit tag which incorporated the subfield code as its last digit.[28] The MINISIS system operates only on the Hewitt Packard 3000 series minicomputers; although very efficient as a stand-alone system, it is a rather inflexible package, and has had to use its own non-standard version of the *Reference Manual* format. Nevertheless there is the capability to produce magnetic tape conforming to ISO 2709 for MINISIS data. A study has recently been undertaken at IDRC sponsored by the International MARC Network Committee to test the feasibility of adapting MINISIS to allow input and output of records in the UNIMARC and CCF formats.

9. REGIONAL FORMATS

Two examples of regional exchange formats have been developed. A regional exchange format is one which is intended to be used in more than one country within a region; as with an international exchange format each country is assumed to have its own system and format and a regional exchange format acts as a switching format between them.

MEKOF is the format of ICSTI, the International Centre for Scientific and

Technical Information in Moscow. This organization is the centre of an information network within the COMECON countries. There are two versions of the format, MEKOF-1 and MEKOF-2[29] which differ mainly in their record structure, though the different record structures do mean that MEKOF-1 is more than just a relabelling of MEKOF-2. MEKOF-2 was the first and is the most developed of the two. It uses the standard record structure of the Normative Technical Prescription (NTP) of ICSTI, no. 2[30] which has a more complex record structure than ISO 2709. MEKOF-1 uses the NTP of ICSTI no. 1[31] which is very close to ISO 2709. Presumably the versions of MEKOF are numbered to correspond with the ICSTI standard numbers. MEKOF-2 being further removed from ISO 2709 has some interesting features. Its tag consists of four digits to accommodate a level indicator. A multi-level record is treated similarly to the *Reference Manual*'s treatment except in a more analytical way—each field within the format can be allocated to any particular level, but, like the *Reference Manual,* only one record is created. A review is treated as a bibliographic level, so that details of a review can be entered in the same record as the item reviewed, to create a link between the two. Accounts of the early development of MEKOF are found in Skripkin and Kodola[32] and Vajda.[33]

INTERMARC[34] was developed by a working group consisting of representatives from Belgium, France, Switzerland and the UK. It was developed about the same time as UNIMARC but as a European exchange format though never used as such. The Belgians based their format on it and the French used it at one time, outside the Bibliothèque Nationale. Nowadays the INTERMARC Software Sub-group is a forum for the airing of problems relating to mechanized bibliographic record storage and retrieval in general, meeting once or twice a year and producing a volume of conference proceedings on each occasion.

INTERMARC is very much like UK MARC except that it has six indicator positions. The first two correspond to the two indicators of UK MARC; 3 and 4 are used as field occurrence indicators 00 to 99 and 5 and 6 are used in a similar way to the level indicator in the British Library's Library Software Package (LSP) format which is used as a means of grouping together fields into sub-records when recording analytics.

10. INTERNATIONAL MARC NETWORK STUDY STEERING COMMITTEE

A meeting of representatives of national libraries was held in Paris in 1975 to discuss policy aspects of the international exchange of bibliographic data in machine-readable form.[35] Richard Coward, Director-General of the British Library Bibliographic Services Division, presented a paper proposing a study on the subject. The resulting International MARC Network Study was undertaken by A. J. Wells[36] and a Steering Committee was set up at the same time. This committee, which is answerable to the Conference of Directors of National Libraries, has outlived the original study and continued to meet once or twice a year since having assisted IFLA in various activities as well as having commissioned a series of occasional papers, for example, *International access to MARC records.*[37] Two of its most recent tasks have been the supervision of the *UNIMARC Handbook*[38] and the commissioning of the study of an implementation of MINISIS using UNIMARC. In 1983 the Committee was renamed the International MARC Network Committee.

11. FUTURE DEVELOPMENTS FOR EXCHANGE FORMATS

Hitherto, exchange formats at the national level have contained detailed instructions as to the form and content of data fields; UK MARC[39] for example refers to sections of the Anglo-American Cataloguing Rules.[40] International exchange formats on the other hand have left the contents of data fields vague in order to be able to accommodate data originating from different formats. This makes for problems since the content of a record in an international exchange format may be so uncontrolled as to be unusable to any recipient. Moreover, those organizations intending to convert their own records into the international exchange format may wish for more guidance as to how to convert their records. UNIMARC is the format of a well-defined set of users, national libraries. It is interesting to see what developments have taken place concerning UNIMARC when speculating on whether international exchange formats have a future as the medium for the exchange of bibliographic records internationally.

The second edition of UNIMARC published by IFLA in 1981[41] contained few revisions and basically followed the same style as the first. A number of national libraries have so far based their formats on UNIMARC: Hungary, Japan, South Africa and Taiwan. As early as 1978 at the second meeting of ABACUS (Association of Bibliographic Agencies of Britain, Australia, Canada and the US) it was agreed in principle to adopt UNIMARC as an exchange format.[42] Yet there is still very little international exchange of bibliographic data and what there is does not yet involve the use of UNIMARC. The British Library takes Library of Congress (LC) records in the US MARC format and converts them as it always has done. About eight other national agencies are believed to take records from LC and seven national agencies take British Library records, but here again the conversion is done only by the receiving library.

The International MARC Network Study Steering Committee (IMNS: SC) commissioned the Deutsche Bibliothek in 1980 to organize a test which included the participation of nine national libraries. A set of title pages for fifty documents, monographs and serials, was circulated to each library. The documents were catalogued by each library according to its own rules and practices, entered in the format used by that library and then converted manually into UNIMARC. Automatic format conversion is a process which needs a great deal of effort expended on it to prepare algorithms even before the programs are written. This test was conducted on a more theoretical basis, and is unlikely to have had that much effort put into it by the participants in the test. However, the test was by no means unsuccessful and an analysis of the test records indicated that the *UNIMARC Manual* did leave open the treatment of a large number of data elements. Independently, the work of the Unesco Ad hoc Group on the Establishment of a Common Communication Format revealed the same weakness in UNIMARC when compared with other international exchange formats, in particular the *UNISIST Reference Manual,* which, as discussed above, contains what amounts to a set of cataloguing rules.

Consequently, the IMNS: SC proposed that an interpretive handbook[38] be prepared which would clarify some of the areas of uncertainty in UNIMARC: the British Library and Library of Congress offered the time of members of staff to undertake this. The aim of the *Handbook* was to make the rules for the use of UNIMARC clearer without favouring one or other existing catalogue code. In many instances, the UNIMARC format document[41] itself is unclear or ambiguous. Often the only hint on a particular kind of treatment is found in the ex-

amples which are not in any case intended to be prescriptive. It will be interesting to see to what extent publication of the *Handbook* will result in greater use of UNIMARC. It is worth noting in this context that members of the Unesco Working Group on Methods, Norms and Standards in Information felt that an implementation manual needs to be prepared for the Common Communication Format in order to give guidance on those data elements which are stated in the format document as having a representation 'According to the practices of the agency preparing the record'.[43,44] Thus it seems the fate of all exchange formats to tend to acquire accompanying cataloguing rules. The future of international formats like UNIMARC will of course depend on external factors which will make attractive or otherwise the exchange of records in machine-readable form. The formats are essentially tape-based, but Avram has stated[45] that the structure can be adapted for use in, for example, online exchanges, and it looks as if ISO 2709 is surviving the advent of the online exchange of data.

Despite attempts to standardize UNIMARC such as the publication of the *Handbook* there will still be differences between records from different sources; it is not yet certain how far international agencies will be prepared to go in either taking records from other sources and merging them into their own files if the access points are not consistent with their own or in editing the records for inclusion in their own file, an activity which might well be so expensive as to outweigh any cost benefit when records from other sources are used in a shared-cataloguing system. One way to resolve these problems would be the establishment of international cataloguing rules and international authority files, both of which exist in the AGRIS and INIS systems contributing to their effectiveness. A number of projects have been proposed in IFLA, including development of a format for machine-readable authority records and a model for an interactive authority data network.[46] Developments like these will determine the future of the international exchange of records, but are outside the scope of this paper.

AUTHOR'S NOTE

The opinions expressed in this paper are those of the author and not necessarily those of the British Library.

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